



## **DEPARTMENT OF TRANSPORTATION**

### **Federal Aviation Administration**

#### **14 CFR Part 39**

**[Docket No. FAA-2022-0279; Project Identifier AD-2022-00257-T; Amendment 39-21982; AD 2022-06-16]**

**RIN 2120-AA64**

#### **Airworthiness Directives; The Boeing Company Airplanes**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule; request for comments.

**SUMMARY:** The FAA is adopting a new airworthiness directive (AD) for all The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes. This AD was prompted by a determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7–3.98 GHz frequency band (5G C-Band), and a recent determination that during takeoff, approach, landings, and go-arounds, as a result of this interference, certain airplane systems may not properly function, resulting in increased flightcrew workload while on approach with the flight director, autothrottle, or autopilot engaged, which could result in reduced ability of the flightcrew to maintain safe flight and landing of the airplane. This AD requires revising the limitations and operating procedures sections of the existing airplane flight manual (AFM) to incorporate specific operating procedures for takeoff, instrument landing system (ILS) approaches, non-precision approaches, and go-around and missed approaches, when in the presence of 5G C-Band interference as identified by Notices to Air Missions (NOTAMs). The FAA is issuing this AD to address the unsafe condition on these products.

**DATES:** This AD is effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].

The FAA must receive comments on this AD by [INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**ADDRESSES:** You may send comments, using the procedures found in 14 CFR 11.43 and 11.45, by any of the following methods:

- Federal eRulemaking Portal: Go to <https://www.regulations.gov>. Follow the instructions for submitting comments.

- Fax: 202-493-2251.

- Mail: U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE, Washington, DC 20590.

- Hand Delivery: Deliver to Mail address above between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

#### **Examining the AD Docket**

You may examine the AD docket at <https://www.regulations.gov> by searching for and locating Docket No. FAA-2022-0279; or in person at Docket Operations between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this final rule, any comments received, and other information. The street address for Docket Operations is listed above.

**FOR FURTHER INFORMATION CONTACT:** Dean Thompson, Aerospace Engineer, Systems and Equipment Section, FAA, Seattle ACO Branch, 2200 South 216th St., Des Moines, WA 98198; phone and fax: 206-231-3165; email: [Dean.R.Thompson@faa.gov](mailto:Dean.R.Thompson@faa.gov).

## **SUPPLEMENTARY INFORMATION:**

### **Background**

In March 2020, the United States Federal Communications Commission (FCC) adopted final rules authorizing flexible use of the 3.7–3.98 GHz band for next generation services, including 5G and other advanced spectrum-based services.<sup>1</sup> Pursuant to these rules, C-Band wireless broadband deployment was permitted to occur in phases with the opportunity for operations in the lower 0.1 GHz of the band (3.7-3.8 GHz) in certain markets beginning on January 19, 2022. This AD refers to “5G C-Band” interference, but wireless broadband technologies, other than 5G, may use the same frequency band.<sup>2</sup> These other uses of the same frequency band are within the scope of this AD since they would introduce the same risk of radio altimeter interference as 5G C-Band.

The radio altimeter is an important aircraft instrument, and its intended function is to provide direct height-above-terrain/water information to a variety of aircraft systems. Commercial aviation radio altimeters operate in the 4.2–4.4 GHz band, which is separated by 0.22 GHz from the C-Band telecommunication systems in the 3.7-3.98 GHz band. The radio altimeter is more precise than a barometric altimeter and for that reason is used where aircraft height over the ground needs to be precisely measured, such as autoland, manual landings, or other low altitude operations. The receiver on the radio altimeter is typically highly accurate, however it may deliver erroneous results in the presence of out-of-band radio frequency emissions from other frequency bands. The radio altimeter must detect faint signals reflected off the ground to measure altitude, in a manner similar to radar. Out-of-band signals could significantly degrade radio altimeter functions during critical phases of flight, if the altimeter is unable to sufficiently reject those signals.

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<sup>1</sup> The FCC’s rules did not make C-Band wireless broadband available in Alaska, Hawaii, and the U.S. Territories.

<sup>2</sup> The regulatory text of the AD uses the term “5G C-Band” which, for purposes of this AD, has the same meaning as “5G”, “C-Band” and “3.7-3.98 GHz.”

The FAA issued AD 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021) (AD 2021-23-12) to address the effect of 5G C-Band interference on all transport and commuter category airplanes equipped with a radio (also known as radar) altimeter. AD 2021-23-12 requires revising the limitations section of the existing AFM to incorporate limitations prohibiting certain operations, which require radio altimeter data to land in low visibility conditions, when in the presence of 5G C-Band interference as identified by NOTAM. The FAA issued AD 2021-23-12 because radio altimeter anomalies that are undetected by the automation or pilot, particularly close to the ground (e.g. landing flare), could lead to loss of continued safe flight and landing.

Since the FAA issued AD 2021-23-12, Boeing has continued to evaluate potential 5G C-Band interference on aircraft systems that rely on radio altimeter inputs. Boeing issued Boeing Multi Operator Message MOM-MOM-22-0034-01B(R2), dated January 28, 2022; Boeing Multi Operator Message MOM-MOM-22-0033-01B(R1), dated January 31, 2022; and Boeing Flight Crew Operations Manual Bulletin TB1-55, “Radio Altimeter Anomalies due to 5G C-Band Wireless Broadband Interference in the United States,” dated January 29, 2022.

Based on Boeing’s data, the FAA identified an additional hazard presented by 5G C-Band interference on The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes. The FAA determined anomalies due to 5G C-Band interference may affect multiple other airplane systems using radio altimeter data, regardless of the approach type or weather. These anomalies may not be evident until very low altitudes. Impacted systems include, but are not limited to, autopilot flight director system; autothrottle system; engines; flight controls; flight instruments; traffic alert and collision avoidance system (TCAS); ground proximity warning system (GPWS); and configuration warnings.

In the event of 5G C-Band interference, landing performance and flightcrew workload can be adversely impacted. 5G C-Band interference may have multiple effects, including:

- Autopilot Flight Director System: NO AUTOLAND caution or advisory message may be shown; NO AUTOLAND autopilot status annunciation may be shown; autopilot may disengage when LAND 2 or LAND 3 status is shown; the flight directors may provide erroneous guidance during ILS approaches; LNAV and VNAV modes may not engage or may engage at an erroneous altitude after departure; autoland flare mode and runway alignment may not occur or may activate earlier or later than expected; or TO/GA mode may not be available.

- Autothrottle System: Autothrottle can remain in SPD (speed) mode and may advance to maintain speed during flare instead of reducing the thrust to IDLE at approximately 25 feet radio altitude; or autothrottle may retard to IDLE prematurely.

- Engines: Thrust levers being set to IDLE in-flight may result in ground idle.

- Flight Controls: SPEEDBRAKE EXT Caution message may not be available. Automatic speedbrake deployment may not occur after touchdown.

- Flight Instruments: The radio altimeter indication may not be shown or may be erroneous; the RADIO minimums indications (flashing or turning amber) may not occur; the rising runway symbol may not be shown or may be erroneous; the localizer deviation alert amber scale and flashing pointer may not be shown (deviation indications are still available); the glideslope deviation alert amber scale and flashing pointer may not be shown (deviation indications are still available); or the Flight Path Vector (FPV) may be biased out of view.

- TCAS: TCAS alerts may not be available (TCAS alerts that do occur will be valid); or TCAS inhibits for resolution advisories may be erroneous.

- GPWS: GPWS alerts may not be available or may be erroneous (although look-ahead terrain alerting remains available); radio altimeter-based altitude and minimums aural callouts during approach may not be available or erroneous; or windshear detection systems (predictive and reactive) may be inoperative.

- Configuration Warnings: Erroneous CONFIG GEAR warning alert may occur.

- Other simultaneous flight deck effects associated with the 5G C-Band interference could increase pilot workload.

These effects may cause erroneous indications and annunciations, as well as conflicting information, to be provided to the flightcrew during a critical phase of flight. There may also be a lack of cues present to elicit prompt go-around or recovery initiation. These effects could lead to reduced ability of the flightcrew to maintain safe flight and landing of the airplane and is an unsafe condition. Thus, the FAA has determined that prompt identification of a potential problem and initiation of a go-around are required to ensure the capability for continued safe flight and landing.

To address this unsafe condition, this AD mandates procedures for operators to incorporate specific operating procedures for takeoff, ILS approaches, non-precision approaches, and go-around and missed approaches, when in the presence of 5G C-Band interference as identified by NOTAMs.

Finally, the FAA notes that AD 2021-23-12 remains in effect and thus prohibits certain ILS approaches. Thus, this AD addresses procedures applicable only to those ILS approaches not prohibited by AD 2021-23-12.

The FAA is issuing this AD to address the unsafe condition on these products.

### **FAA's Determination**

The FAA is issuing this AD because the agency has determined the unsafe condition described previously is likely to exist or develop in other products of the same type design.

## **AD Requirements**

This AD requires revising the limitations and operating procedures sections of the existing AFM to incorporate specific operating procedures for takeoff, instrument landing system (ILS) approaches, non-precision approaches, and go-around and missed approaches, when in the presence of 5G C-Band interference as identified by NOTAMs.

## **Compliance with AFM Revisions**

Section 91.9 prohibits any person from operating a civil aircraft without complying with the operating limitations specified in the AFM. FAA regulations also require operators to furnish pilots with any changes to the AFM (14 CFR 121.137) and pilots in command to be familiar with the AFM (14 CFR 91.505).

## **Interim Action**

The FAA considers this AD to be an interim action. If final action is later identified, the FAA might consider further rulemaking.

## **Justification for Immediate Adoption and Determination of the Effective Date**

Section 553(b)(3)(B) of the Administrative Procedure Act (APA) (5 U.S.C. 551 *et seq.*) authorizes agencies to dispense with notice and comment procedures for rules when the agency, for “good cause,” finds that those procedures are “impracticable, unnecessary, or contrary to the public interest.” Under this section, an agency, upon finding good cause, may issue a final rule without providing notice and seeking comment prior to issuance. Further, section 553(d) of the APA authorizes agencies to make rules effective in less than thirty days, upon a finding of good cause.

An unsafe condition exists that requires the immediate adoption of this AD without providing an opportunity for public comments prior to adoption. The FAA has found that the risk to the flying public justifies forgoing notice and comment prior to adoption of this rule because the FAA determined that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless

broadband operations in the 5G C-Band, and a determination that during takeoff, approach, landings, and go-arounds, as a result of this interference, certain airplane systems may not properly function, resulting in increased flightcrew workload while on approach with the flight director, autothrottle, or autopilot engaged. This increased flightcrew workload could lead to reduced ability of the flightcrew to maintain safe flight and landing of the airplane. The urgency is based on the hazard presented by 5G C-Band interference, and on C-Band wireless broadband deployment, which has been occurring in phases with operations beginning on January 19, 2022. Accordingly, notice and opportunity for prior public comment are impracticable and contrary to the public interest pursuant to 5 U.S.C. 553(b)(3)(B).

In addition, the FAA finds that good cause exists pursuant to 5 U.S.C. 553(d) for making this amendment effective in less than 30 days, for the same reasons the FAA found good cause to forgo notice and comment.

### **Comments Invited**

The FAA invites you to send any written data, views, or arguments about this final rule. Send your comments to an address listed under ADDRESSES. Include Docket No. FAA-2022-0279 and Project Identifier AD-2022-00257-T at the beginning of your comments. The most helpful comments reference a specific portion of the final rule, explain the reason for any recommended change, and include supporting data. The FAA will consider all comments received by the closing date and may amend this final rule because of those comments.

Except for Confidential Business Information (CBI) as described in the following paragraph, and other information as described in 14 CFR 11.35, the FAA will post all comments received, without change, to <https://www.regulations.gov>, including any personal information you provide. The agency will also post a report summarizing each substantive verbal contact received about this final rule.



## Confidential Business Information

CBI is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to this AD contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this AD, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as “PROPIN.” The FAA will treat such marked submissions as confidential under the FOIA, and they will not be placed in the public docket of this AD. Submissions containing CBI should be sent to Dean Thompson, Aerospace Engineer, Systems and Equipment Section, FAA, Seattle ACO Branch, 2200 South 216th St., Des Moines, WA 98198; phone and fax: 206-231-3165; email: Dean.R.Thompson@faa.gov. Any commentary that the FAA receives that is not specifically designated as CBI will be placed in the public docket for this rulemaking.

## Regulatory Flexibility Act

The requirements of the Regulatory Flexibility Act (RFA) do not apply when an agency finds good cause pursuant to 5 U.S.C. 553 to adopt a rule without prior notice and comment. Because the FAA has determined that it has good cause to adopt this rule without notice and comment, RFA analysis is not required.

## Costs of Compliance

The FAA estimates that this AD affects 126 airplanes of U.S. registry. The FAA estimates the following costs to comply with this AD:

Estimated costs				
Action	Labor cost	Parts cost	Cost per product	Cost on U.S. operators
AFM revision	1 work-hour X \$85 per hour = \$85	\$0	\$85	\$10,710

## **Authority for this Rulemaking**

Title 49 of the United States Code specifies the FAA's authority to issue rules on aviation safety. Subtitle I, section 106, describes the authority of the FAA Administrator. Subtitle VII: Aviation Programs describes in more detail the scope of the Agency's authority.

The FAA is issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701: General requirements. Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

## **Regulatory Findings**

This AD will not have federalism implications under Executive Order 13132. This AD will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.

For the reasons discussed above, I certify that this AD:

- (1) Is not a "significant regulatory action" under Executive Order 12866, and
- (2) Will not affect intrastate aviation in Alaska.

## **List of Subjects in 14 CFR Part 39**

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

## **The Amendment**

Accordingly, under the authority delegated to me by the Administrator, the FAA amends 14 CFR part 39 as follows:

## **PART 39 - AIRWORTHINESS DIRECTIVES**

1. The authority citation for part 39 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

### **§ 39.13 [Amended]**

2. The FAA amends § 39.13 by adding the following new airworthiness directive:

**2022-06-16 The Boeing Company:** Amendment 39-21982; Docket No. FAA-2022-0279; Project Identifier AD-2022-00257-T.

#### **(a) Effective Date**

This airworthiness directive (AD) is effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].

#### **(b) Affected ADs**

None.

#### **(c) Applicability**

This AD applies to all The Boeing Company Model 747-100, 747-100B, 747-100B SUD, 747-200B, 747-200C, 747-200F, 747-300, 747-400, 747-400D, and 747-400F series airplanes, certificated in any category.

#### **(d) Subject**

Air Transport Association (ATA) of America Code 34, Navigation.

#### **(e) Unsafe Condition**

This AD was prompted by a determination that radio altimeters cannot be relied upon to perform their intended function if they experience interference from wireless broadband operations in the 3.7–3.98 GHz frequency band (5G C-Band), and a recent determination that during takeoff, approach, landings, and go-arounds, as a result of this interference, certain airplane systems may not properly function, resulting in increased flightcrew workload while on approach with the flight director, autothrottle, or autopilot engaged. The FAA is issuing this AD to address 5G C-Band interference that

could result in increased flightcrew workload and could lead to reduced ability of the flightcrew to maintain safe flight and landing of the airplane.

**(f) Compliance**

Comply with this AD within the compliance times specified, unless already done.

**(g) Airplane Flight Manual (AFM) Revision**

(1) Within 2 days after the effective date of this AD: Revise the Limitations section of the existing AFM to include the information specified in figure 1 to paragraph (g)(1) of this AD. This may be done by inserting a copy of figure 1 to paragraph (g)(1) of this AD into the Limitations section of the existing AFM.

**Figure 1 to paragraph (g)(1) – AFM Limitations Revision**

**(Required by AD 2022-06-16)**

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

The following limitations are required for dispatch or release to airports, and takeoff, approach, landing, and go-around on runways, in U.S. airspace in the presence of 5G C-Band wireless broadband interference as identified by NOTAM (NOTAMs will be issued to state the specific airports or approaches where the radio altimeter is unreliable due to the presence of 5G C-Band wireless broadband interference).

**Takeoff, Approach, Landing, and Go-Around**

Operators must use the Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around procedure contained in the Operating Procedures section of this AFM.

(2) Within 2 days after the effective date of this AD: Revise the Operating Procedures section of the existing AFM to include the information specified in figure 2 to paragraph (g)(2) of this AD. This may be done by inserting a copy of figure 2 to paragraph (g)(2) of this AD into the Operating Procedures section of the existing AFM.

**Figure 2 to paragraph (g)(2) – AFM Operating Procedures Revision**

**(Required by AD 2022-06-16)**

**Radio Altimeter 5G C-Band Interference, Takeoff, Approach, Landing, and Go-Around**

**Takeoff**

If autopilot does not engage above the minimum altitude, when at a safe altitude, select both flight director switches OFF, then ON, to re-engage. LNAV and VNAV may not engage or engage at an erroneous altitude after departure.

**ILS Approaches**

For ILS approaches, disconnect the autopilot and autothrottle, and place both flight director switches to OFF prior to glideslope intercept. Do not set RADIO minimums on the EFIS control panel, use BARO minimums only.

**Non-Precision Approaches**

Autopilot, autothrottles, and flight directors may be used. Do not use autothrottles if the autopilot is disengaged. Prior to descending below MDA, disconnect the autothrottle and disengage the autopilot.

**Landing**

Do not rely on radio altimeter-based altitude aural callouts during approach. Adjust operational (time of arrival) landing distance for manual speedbrake deployment.

**During Go-Around and Missed Approach**

If go-around is required, ensure thrust is increased to go-around power.

When the flight director switches are OFF, push either TO/GA switch to display the flight director bars. When able, turn both flight directors to ON.

TO/GA mode may not be available. Autopilot may not be available. Monitor pitch and roll modes for engagement.

Note 1 to paragraph (g)(2): Guidance for accomplishing the actions required by paragraph (g)(2) of this AD can be found in Boeing Multi Operator Message MOM-MOM-22-0034-01B(R2), dated January 28, 2022; Boeing Multi Operator Message MOM-MOM-22-0033-01B(R1), dated January 31, 2022; and Boeing Flight Crew Operations Manual Bulletin TB1-55, “Radio Altimeter Anomalies due to 5G C-Band Wireless Broadband Interference in the United States,” dated January 29, 2022.

**(h) Alternative Methods of Compliance (AMOCs)**

(1) The Manager, Seattle ACO Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In

accordance with 14 CFR 39.19, send your request to your principal inspector or responsible Flight Standards Office, as appropriate. If sending information directly to the manager of the certification office, send it to the attention of the person identified in paragraph (i)(1) of this AD. Information may be emailed to: 9-ANM-Seattle-ACO-AMOC-Requests@faa.gov.

(2) Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the responsible Flight Standards Office.

(3) AMOCs approved for AD 2021-23-12, Amendment 39-21810 (86 FR 69984, December 9, 2021), providing relief for specific radio altimeter installations are approved as AMOCs for the provisions of this AD.

**(i) Related Information**

(1) For more information about this AD, contact Dean Thompson, Aerospace Engineer, Systems and Equipment Section, FAA, Seattle ACO Branch, 2200 South 216th St., Des Moines, WA 98198; phone and fax: 206-231-3165; email: Dean.R.Thompson@faa.gov.

(2) For service information identified in this AD that is not incorporated by reference, contact Boeing Commercial Airplanes, Attention: Contractual & Data Services (C&DS), 2600 Westminister Blvd., MC 110 SK57, Seal Beach, CA 90740-5600; telephone 562-797-1717; Internet <https://www.myboeingfleet.com>.

**(j) Material Incorporated by Reference**

None.

Issued on March 9, 2022.

Lance T. Gant, Director,  
Compliance & Airworthiness Division,  
Aircraft Certification Service.

[FR Doc. 2022-05576 Filed: 3/11/2022 4:15 pm; Publication Date: 3/16/2022]